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(71) Applicant *(for all designated States except US)*: **DOCTORS TECH CO., LTD.** [KR/KR]; 614-3 Shinsa-dong, Kangnam-ku, Seoul 135-120 (KR).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **KIM, Won-Seok** [KR/KR]; 3-1505 Kukdong Apartment, 428, Oksu-dong, Sungdong-ku, Seoul 133-100 (KR). **PARK, Jong-Wook** [KR/KR]; 612-1403 Byuksan Apartment, Yatap-dong, Bundang-ku, Seongnam-city, Kyungki-do 463-927 (KR). **CHO, Hee-Yoon** [KR/KR]; 3-108 Hanyang Apartment, Apkujong-dong, Kangnam-ku, Seoul 135-794 (KR).

(74) Agent: **KIM, Won-Ho**; Teheran Bldg., 825-33, Yoksam-dong, Kangnam-ku, Seoul 135-080 (KR).

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(54) Title: METHOD FOR TRANSDERMAL ADMINISTRATION OF ASCORBIC ACID

(57) Abstract: The present invention relates to a method for transdermal administration of ascorbic acid and to a skin-care apparatus. The present invention provides a method for transdermal administration of ascorbic acid, characterized in that a metal phosphate salt of ascorbic acid is penetrated into skin by iontophoresis, which comprises periodically applying a positive voltage of 3 to 20v, a negative voltage of 3 to 20v and current of 0.01 to 1.0 mA to transdermally administrate an aqueous solution composition comprising a metal phosphate salt of ascorbic acid, and a skin-care apparatus using the iontophoresis and ultrasonic waves. The method of the present invention exhibits the effects of freckle removal, melasma remove, acne removal, sebaceous matter removal, wrinkle removal, skin-aging prevention and whitening.

# Method for transdermal administration of ascorbic acid

## BACKGROUND OF THE INVENTION

### (a) Field of the Invention

The present invention relates to a method for transdermal administration of ascorbic acid and to a skin care apparatus using ultrasonic waves. More particularly, the present invention relates to a method for transdermal administration of ascorbic acid that effectively penetrates ascorbic acid that is unstable in an aqueous solution and has low transdermal administration efficiency into skin, and to a skin-care apparatus that enables the transdermal administration of vitamins by ultrasonic cleansing and iontophoresis using one apparatus.

### (b) Description of the Related Art

In general, ascorbic acid, also known as Vitamin C, has an efficacy of maintaining healthy and attractive skin. In addition, medically, it promotes the formation of collagen in human skin to slow down or prevent skin-aging and the formation of wrinkles, and it is also known to have an effect of preventing skin damage due to ultraviolet rays.

In addition, ascorbic acid is known to have an effect of inhibiting the formation of histamine, which is believed to be a cause of the formation of

melanin, which induces pigmentations, and various allergies, particularly skin allergies appearing in persons having sensitive skin.

Accordingly, there has been an attempt to use ascorbic acid in cosmetics or medicines having whitening effects for freckles as well as for wrinkle-removing effects.

As methods for administrating ascorbic acid in human bodies, oral administration and transdermal administration methods have been proposed. According to the oral administration method, ascorbic acid can be stored and used in a comparatively stable form, because the method employs powdered ascorbic acid. However, since a transfer process to relevant skin is inefficient, the actual efficiency, which is a ratio of active ingredients penetrated into skin to total dose, is very low.

A transdermal administration method where ascorbic acid is directly administrated into skin is preferable in order to increase the actual efficiency. However, the efficiency for transdermal administration of ascorbic acid is low, ascorbic acid has very low solubility in a non-aqueous medium, and if dissolved in an aqueous medium it is easily oxidized and therefore loses its unique function, and thus this method is not practical.

In order to improve such instability of ascorbic acid, U.S. Patent No. 4,983,382 has suggested a method of using water and organic solvents such as ethanol together as a medium, and U.S. Patent No. 5,981,578 has suggested a method of simultaneously applying a non-aqueous solution comprising ascorbic acid and other products such as a wash and lotion

containing water to skin.

As another method for improving instability of ascorbic acid, a method for stabilizing it by combining it with other compounds to form a derivative is known.

As examples, Korean Patent Application No. 97-23005 discloses synthesizing ascorbic acid having excellent stability by reacting L-ascorbic acid with 3-aminopropyl phosphate, and cosmetic formulations including a lotion, a nutrition cream, a massage cream, an essence, etc. containing the ascorbic acid derivatives as active ingredients. However, when ascorbic acid is mixed with cosmetics and transdermally administrated, a transfer process to skin is inefficient and thus the actual efficiency is low.

## SUMMARY OF THE INVENTION

It is an object of the present invention to provide an ascorbic acid composition that can be transdermally administrated by iontophoresis.

It is another object of the present invention to provide an effective method for transdermal administration of ascorbic acid.

It is another object of the present invention to provide a method for transdermal administration, which can penetrate ascorbic acid into skin in a stable form.

It is still another object of the present invention to provide a skin-care apparatus enabling smooth transdermal administration of ascorbic acid.

In order to achieve these objects, the present invention provides an ascorbic acid composition for iontophoresis comprising:

(a) 1 to 10wt% of a mixture comprising:

(i) 1 to 80wt% of additives comprising α -G-rutin, trehalose, aloe vera gel and alantoin in a weight ratio of 1-25 : 1-50 : 1-50 : 1-50; and

(ii) 20 to 99wt% of metal phosphate salt of ascorbic acid; and

(b) 90 to 99wt% of water.

In addition, the present invention provides a method for transdermal administration of ascorbic acid, which penetrates metal phosphate salts of ascorbic acid into skin by ionotophoresis. The iontophoresis is preferably conducted by placing one electrode on the skin coated with an aqueous solution containing metal phosphate salts of ascorbic acid and constituting a circuit with the skin, thereby penetrating metal phosphate salts of ascorbic acid into skin, and more preferably, it is conducted by periodically generating a positive voltage of 3 to 20v at a pulse of 10-100Hz and a negative voltage of 3 to 20v at a pulse of 60-1000Hz and applying them to the skin at current of 0.01 to 1.0mA.

In addition, the present invention provides a skin-care apparatus comprising:

an electric source part to which an alternating current (AC) is input;

a processor part that is operated by direct current (DC) supplied from the electric source part, and that controls the amplitude of vibration, operation time, and iontophoresis current amount;

a resonance part that is connected to the electric source part by AC

and causes pulses to resonate to ultrasonic waves;

an amplification part that amplifies the resonated pulses; and

an iontophoresis-vibration part that is connected to the amplification part, and which enables iontophoresis and ultrasonic massage to be conducted by way of a contact plate that is in contact with skin, whereby vibrations are generated by surface-attached piezoelectric elements.

## BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing the skin-care apparatus of the present invention.

Fig. 2 is a planar view of a vibration part of the skin-care apparatus of the present invention.

Fig. 3 is a side view of a vibration part of the skin-care apparatus of the present invention.

Fig. 4 shows the iontophoresis apparatus used in the present invention.

Fig. 5 is a photo of a patient having melasma before medical treatment according to the present invention.

Fig. 6 is a photo of the same person of Fig. 5 after administrating an ascorbic acid composition of the present invention.

Fig. 7 is a photo of a patient having melasma before medical treatment according to the present invention.

Fig. 8 is a photo of the same person of Fig. 7 after ultrasonic cleansing and administration of an ascorbic acid composition according to

the present invention.

Fig. 9 is a photo of a patient having acne before medical treatment according to the present invention.

Fig. 10 is a photo of the same person of Fig. 9 after administrating an ascorbic acid composition of the present invention.

Fig. 11 is a photo of a patient having acne before medical treatment according to the present invention.

Fig. 12 is a photo of the same person after ultrasonic cleansing and administration of an ascorbic acid composition.

Fig. 13 is a photo showing the appearance around wrinkles before medical treatment according to the present invention.

Fig. 14 is a photo showing the same part of Fig. 13 after ultrasonic cleansing and administration of an ascorbic acid composition.

| | | | |
|---|---|---|---|
| 10 | electric source part | 20 | processor part |
| 22 | LED lamp | 24 | switch |
| 30 | resonance part | 40 | amplification part |
| 50 | iontophoresis part | 60 | vibration part |
| 70 | case | 72 | contact plate |
| 74 | piezoelectric elements | 76 | aluminum plate |
| 78 | ground part | 80 | sponge cover |

## DETAILED DESCRIPTION AND THE PREFERRED EMBODIMENTS

The present invention will now be explained in more detail.

The present inventors have discovered that if ascorbic acid is

converted to its metal phosphate salt form and transdermally administrated by iontophoresis, the metal phosphate salts of ascorbic acid can be rapidly and effectively penetrated into the skin. Once there, the metal phosphate salts are decomposed by enzymes and changed to ascorbic acid, which exhibits unique functions such as melanin-formation inhibiting effects, etc., and the oxidation of the ascorbic acids can be prevented or inhibited even in aqueous forms.

A metal phosphate salt of ascorbic acid can be prepared by reacting ascorbic acid, phosphorous oxychloride and a metal chloride salt, or it is available from Sigma Company in the US, and Wako Company or Niko Company in Japan.

The metal phosphate salts of ascorbic acid is preferably selected from a group consisting of sodium phosphate salt, magnesium phosphate salt, calcium phosphate salt and potassium phosphate salt of ascorbic acid, and magnesium phosphate salt is most preferable.

The metal phosphate salt of ascorbic acid used in the present invention can be prepared by the following method.

An L-ascorbic acid is mixed with acetone and strength oleum at 0℃, the mixture is stirred for 6 hours, its temperature is lowered to -15℃, and the obtained crystallized solids are vacuum-dried. The vacuum-dried mixture is mixed with water and pyridine, $POCl_3$ is slowly added thereto at 0℃, and the mixture is stirred for 30 minutes while maintaining a pH at 13. Hydrated magnesium chloride ($MgCl_2 \cdot 6H_2O$) is added to the mixture, and the mixture

is stirred for 1 to 2 hours and the produced crystals are removed. Methanol is added to the mixture, the resultant mixture is stirred for 1 hour and the produced crystals are removed. The solution is then evaporated from the mixture and MgO and water are added thereto and stirred while maintaining the pH at 8.5 to 9. The mixture is added to methanol, and the produced crystals are filtered and washed with methanol to obtain a magnesium phosphate salt of ascorbic acid.

When the obtained metal phosphate salt of ascorbic acid, preferably magnesium-L-ascorbyl-2-phosphate, is penetrated into bodies, phosphate and magnesium leave the salt during passage through cell membranes, and the salt changes into ascorbic acid (Vitamin C), thereby making its effects available for skin.

The ascorbic acid composition for transdermal administration of the present invention is prepared by mixing α -G-rutin, alantoin, aloe vera gel, and trehalose with the metal phosphate salt of ascorbic acid prepared by the above-explained method. The composition of the present invention preferably comprises 1 to 10wt% of a mixture comprising 20 to 99wt% of metal phosphate salt of ascorbic acid and 1 to 80wt% of additives, and 90 to 99wt% of water.

The additives preferably comprise α -G-rutin, alantoin, aloe vera gel, and trehalose in a weight ratio of 1-25 : 1-50 : 1-50 : 1-50. The metal phosphate salt of ascorbic acid is stable even in an aqueous solution and thus it is not decomposed, and it forms a very stable composition that does

not show discoloration or precipitation with surfactants.

The ascorbic acid composition for transdermal administration is administrated into skin by iontophoresis. The present invention includes iontophoresis, which passes currents through electrolyte comprising ionic materials, thereby penetrating the ionic materials into body tissues, and an electrophoresis, which applies a voltage to skin to transfer uncharged materials into bodies.

One example of iontophoresis is a method for transdermal administration of active ingredients by constituting a circuit by contacting one electrode each of an anode and a cathode with skin coated with an aqueous solution composition containing a metal phosphate salt of ascorbic acid, and thereby administrating the metal phosphate salt of ascorbic acid by voltage differences. Apparatus for conducting such iontophoresis are commonly known in the art, and the structure and direction for use thereof are disclosed in, as examples, U.S. Patent No. 5,314,502, and Korean Patent Nos. 154112, 192161 and 203225.

The method for transdermal administration of ascorbic acid of the present invention is preferably conducted by periodically generating a positive voltage of 3 to 20v at a pulse of 10-100Hz and a negative voltage of 3 to 20v at a pulse of 60-1000Hz, and applying them to skin at current of 0.01 to 1.0mA, while applying ultrasonic vibrations of 23-40kHz to skin at a cycle of 1-100Hz. If the voltage exceeds 20v, the epidermal layer of skin may have hypersensitive responses due to chlorine or medicine, and if the

voltage is less than 3v, the formed electric energy will be insufficient for the metal phosphate salt of ascorbic acid to permeate the cell membrane of the epidermal layer. Charged ascorbic acid salt penetrates into skin through cell holes formed by electrical shock, and then phosphate salt is isolated by phosphatase located on the intracellular membrane, which leaves only ascorbic acid. The produced ascorbic acid reduces dopaquinone at a melanocyte, which is an important intermediate of tyrosinase reaction, and thus inhibits melanin formation thereby exhibiting pigment-removing effects. In addition, it can prevent and remove wrinkles by accumulating collagen.

In addition, according to the iontophoresis of the present invention, a transdermal administration rate of metal phosphate salt of ascorbic acid can be increased, and additional effects of promoting dissolution and discharge of waste products of skin are obtained by supplying currents to skin. Accordingly, acne and melasma, which are continuously produced on the surface of skin and cause skin troubles such as excretion difficulty in the openings of sebaceous glands as well as skin-contaminations, can be removed, and thus healthy skin can be maintained.

In addition, ultrasonic massage of skin preceding transdermal administration of a metal phosphate salt of ascorbic acid by iontophoresis may further improve transdermal administration effects of ascorbic acid. In the present invention, ultrasonic vibrations are generated through 3 steps of skin-cleansing in which ultrasonic vibrations of 20 to 40kHz with a weak amplitude are generated, skin-scaling in which ultrasonic vibrations of 20 to

40kHz with a strong amplitude are generated, and lifting in which ultrasonic waves of 20 to 40 kHz at a cycle of 1-100Hz and a pulse current of 0.01-0.1mA are generated. The lifting step can be conducted after iontophoresis. The most preferable ultrasonic massage method comprises cleansing, scaling, iontophoresis and lifting.

The ultrasonic massage according to the above method penetrates ultrasonic energies into deep parts of bodies as well as skin tissues to activate cells of skin, nerve, lymphatics, blood vessels and muscle layers, and it promotes metabolism to elevate effects of ascorbic acid.

In addition, the present invention provides a skin-care apparatus for transdermal administration of ascorbic acid. The skin-care apparatus of the present invention comprises an electric source part to which an alternating current (AC) electric source is input; a processor part that is operated by direct current (DC) supplied from the electric source part, and that controls the amplitude of vibrations, operation time and the amount of iontophoresis current; a resonance part that is connected to the electric source part by AC and causes pulses to resonate to ultrasonic waves; an amplification part that amplifies the resonated pulses; and an iontophoresis-vibration part that is connected to the amplification part, and which enables the iontophoresis and ultrasonic massage to be conducted by way of a contact plate that is in contact with skin, whereby surface-attached piezoelectric elements generate vibrations.

The present invention will now be explained in more detail with

reference to the desired embodiment.

Fig. 1 is a block diagram showing the skin-care apparatus of the present invention.

An alternating current (AC) electric source is applied to an electric source part (10), and the applied AC electric source is converted to DC or left at AC and input in a processor part or a resonance part, as will be explained.

The processor part (20) is operated by DC that is input through the electric source part (10), and it controls the vibration amplitude of pulses, operation time and the amount of iontophoresis current.

In addition, an LED lamp (22) and a switch (24) are connected to the processor part (20), and the degree of operation progress of ultrasonic cleansing of skin or iontophoresis and the skin-care step in progress can be identified.

The resonance part (30) comprises a coil and a condenser, and it causes a resonance when the frequency of the electric source concurs with a characteristic frequency.

At this time, the frequency that is resonated to its maximum by the resonance part is amplified to a degree of 20 to 40kHz, and more preferably to 25 kHz, at an amplification part (40).

An iontophoresis-vibration part is divided into an iontophoresis part (50) and a vibration part (60), and they have a contact plate (72) in common, where current is communicated with the amplification part (40) inside a case (70), as shown in Figs. 2 and 3.

The contact plate (72) is made of stainless steel that is harmless to human bodies and has a good contact feel.

Specifically, on the front end of the contact plate (72), which directly contacts human bodies, a coating film made of titanium nitride (TiN) or zirconium nitride (ZrN) is formed so as to protect skin that is sensitive to metals and that shows allergic responses.

The coating film can be deposited using a Chemical Vapor Deposition method that is used in semiconductor processes, or a sputtering method.

An aluminum plate (76) where piezoelectric elements (74) are fixed is attached to the upper and lower sides of the contact plate (72), as shown in Fig. 3, and the aluminum plate can be replaced by duralumin.

A circuit for iontophoresis is connected to the stainless steel contact plate, and a circuit for ultrasonic cleansing is connected to the piezoelectric elements (74).

Thus the ultrasonic cleansing can be individually conducted, or the ultrasonic massage and the iontophoresis can be simultaneously conducted.

A ground part (78) can be connected to the contact plate (72). By current communication with the ground part (78), the current of one electrode from the electric source part (10) is transferred via a contact plate (72) to the contacted skin and reaches to the other electrode in the ground part (78) that is held by hand to form a circuit.

The electrodes of the electric source (10) and the ground part (78)

can be positive voltage/negative voltage or negative voltage/positive voltage.

Meanwhile, a sponge cover (80) can be inserted into the front end of the contact plate (72), which is used when transdermally administrated agents such as medicines, cosmetics or an ascorbic acid composition, etc. are penetrated into skin by iontophoresis.

Specifically, the sponge cover (80) is inserted into the front end of the contact plate (72), and the front end is dampened with the ascorbic acid composition of the present invention so that the aqueous solution can be absorbed in the sponge cover (80), under which condition the iontophoresis is conducted.

It is preferable to form inserting grooves on both sides of the front end so that the sponge cover (80) can be securely inserted in the front end of the contact plate (72).

With the skin-care apparatus of the present invention, skin-care can be performed in 4 modes, as will be explained.

The 4 skin-care modes include a cleansing mode, a scaling mode, a vitamin mode and a lifting mode, among which the cleansing and scaling modes use ultrasonic waves, and the vitamin and lifting modes use both ultrasonic waves and iontophoresis.

When a cleansing mode is selected after supplying an electric source to the electric source part (10), the processor part (20) controls the vibration amplitude of ultrasonic waves and operation time suitable for the cleansing mode.

Thus resonance is generated in the resonance part (30) to become vibrations of 20 to 40kHz with a weak amplitude, and the contact plate (72) begins to vibrate as the piezoelectric elements (74) vibrate.

Next, prepared clean water is applied to the skin in a suitable amount, and the front end of the contact plate is adhered closely to the skin and vibrations are applied for 5 minutes while maintaining the angle between the front end of the contact plate and skin surface at 45° .

In the case of a scaling mode, vibrations of 20 to 40kHz with a strong amplitude are applied to the skin for 5 minutes.

In the case of a vitamin mode, it is preferable to periodically generate a positive voltage of 3 to 20v at a pulse of 10-100Hz and a negative voltage of 3 to 20v at a pulse of 60-100Hz, and to apply current of 0.01 to 1.0mA to the skin, while applying ultrasonic vibrations of 23-40kHz with a cycle of 1 to 100Hz for 10 minutes.

If the voltage exceeds 20v, the epidermal layer of the skin may have hypersensitive response due to chlorine or medicine, and if it is less than 3v, the formed energies will be insufficient for the metal phosphate salt of ascorbic acid to penetrate cell membranes of the epidermal layer.

When conducting the vitamin mode, the sponge cover (80) covers the front end of the contact plate (72), and it is dampened with the ascorbic acid composition.

At this time, iontophoresis and ultrasonic massage can be simultaneously conducted since the iontophoresis and vibration are

simultaneously employed.

Particularly, if the ground part (78) is held by hand, ascorbic acid will be penetrated into the skin by the current.

Finally, in the case of the lifting mode, a moisturizing agent is sufficiently and uniformly applied to the face, and vibrations of 23 to 40kHz with a cycle of 1 to 100Hz and a pulse current of 0.01 to 1.0mA/$cm^2$, are applied to the skin for 10 minutes. At this time, face muscles are tensed and released at a most optimal frequency, which results in the highest massaging effects.

The present invention will be explained in more detail with reference to the following Example. However, the Example is to illustrate the present invention and the present invention is not limited thereto.

[Example 1]

Preparation of Magnesium Ascorbyl Phosphate

480 ㎖ of acetone and 43g of strength oleum were added to 120g of L-ascorbic acid at 0℃, and the mixture was stirred for 6 hours, cooled to -15℃ and the formed crystals were vacuum-dried. 1.2 liters of water and 300 ㎖ of pyridine were mixed with the vacuum-dried mixture, 146g of $POCl_3$ were slowly added thereto at 0℃, and the mixture was stirred for 30 minutes at a pH of 13. 70g of hydrated magnesium chloride ($MgCl_2 \cdot 6H_2O$) were added thereto and the mixture was stirred for 2 hours and then filtered. 1 liter of methanol was added to the filtrate, the filtrate was stirred for 1 hour

and filtered, and solutions were evaporated from the filtrate. 39g of MgO were added thereto with water and stirred while maintaining pH at 8.5 to 9. The mixed solution was slowly added to 1.2 liters of methanol, and the obtained crystals were filtered and washed with 300 ㎖ of methanol to obtain magnesium ascorbyl phosphate.

Preparation of Composition for Transdermal Administration

0.2g of the prepared magnesium ascorbyl phosphate, 0.02g of α -G-rutin, 0.1g of alantoin, 0.1g of aloe vera gel, 0.1g of trehalose and 5g of water were mixed to prepare an ascorbic acid composition for transdermal administration.

Iontophoresis Treating Method

Fig. 4 shows the iontophoresis device used in the present invention, which comprises an electric source part (1), 6 piezoelectric elements (2), a stainless steel plate ((3):SUS), and a bar (4). One electrode current from the electric source part is transferred via the stainless steel plate to the contacted skin, and it reaches another electrode in a hand-held bar to form a circuit. At this time, the electrodes of the electric source part and the bar can be positive voltage/negative voltage or negative voltage/positive voltage.

In addition, the iontophoresis device of Fig. 4 can tansdermally transfer ultrasonic vibrations using piezoelectric elements and thus it can be used in ultrasonic massage.

A method for transdermal administration of the ascorbic acid composition by iontophoresis was conducted as follows:

3 to 10 ㎖ of the ascorbic acid composition were coated on the face, a positive voltage of 3 to 20v at a pulse of 60Hz and a negative voltage of 3 to 20v at a pulse of 500Hz were periodically generated and applied to skin at a current of 0.01 to 1.0mA. These operations were conducted twice a week.

[Example 2]

Directions for Use of the Apparatus

Ultrasonic cleansing and iontophoresis were conducted using the apparatus of Fig. 4 as follows:

(1) Cleansing : Water was applied to skin and vibrations of 25kHz with a weak amplitude were applied to the skin for 5 minutes.

(2) Scaling : Vibrations of 25kHz with a strong amplitude were applied to the skin for 5 minutes.

(3) Vitamin : Ultrasonic vibrations of 25kHz were applied to the skin for 10 minutes at a cycle of 10Hz, while applying pulse current of 0.05 to 0.5mA/cm2 to skin and contacting sponge dampened with vitamin C solution with skin.

(4) Lifting : Pulse AC current of 0.01-0.1mA and ultrasonic vibrations of 25kHz with a cycle of 10Hz were applied to skin for 10 minutes.

[Experiment]

The ascorbic acid was transdermally administrated to persons having serious melasma, acne or wrinkles twice a week, according to the methods of Example 1 and 2. After 1 month and 2 months had elapsed, the effects were observed. The results are presented in Table 1. The degree

of effects were measured by the naked-eye and gave 0 points for the poorest, and 10 points for the best.

[Table 1]

| | No Ascorbic acid Treatment | After Treating Ascorbic acid salt | | | |
|---|---|---|---|---|---|
| | | No Ultrasonic wave Treatment | | Treating Ultrasonic wave | |
| Time (days) | 1 Month | 1 Month | 2 Months | 1 Month | 2 Months |
| Freckle-Removal | 0 | 5 | 7 | 7 | 10 |
| Acne Removal | 0 | 5 | 8 | 6 | 10 |
| Wrinkle-Removal | 0 | 4 | 5 | 5 | 7 |

Figs. 5 to 14 are photos showing the results of Table 1. Fig. 5 shows the appearance of a patient having melasma before treating with the ascorbic acid composition, and Fig. 6 shows the same person after treating with the ascorbic acid composition for 2 months. Fig. 7 shows the appearance of a patient having melasma before treating with the ascorbic acid composition, and Fig. 8 shows the same person after treating with the ascorbic acid composition and ultrasonic cleansing for 2 months. Fig. 9 shows the appearance of a patient having acne before treating with the ascorbic acid composition, and Fig. 10 shows the same person after treating with the ascorbic acid composition for 2 months. Fig. 11 shows the appearance of a patient having acne before treating with the ascorbic acid

composition, and Fig. 12 shows the same person after treating with ultrasonic cleansing and the ascorbic acid composition for 2 months. Fig. 13 shows the appearance around wrinkles before treating with the ascorbic acid composition, and Fig. 14 shows the appearance of the same part after treating with ultrasonic cleansing and the ascorbic acid composition for 2 months. It can be seen that the ascorbic acid composition of the present invention showed excellent effects for removing melasma, acne and wrinkles, and simultaneous ultrasonic cleaning improved the effects.

As stated above, according to the present invention, the ascorbic acid composition is transdermally administrated by iontophoresis using a skin-care apparatus, thereby exhibiting the effects of melasma removal, acne removal, sebaceous matter removal, wrinkle removal, skin aging prevention and whitening.

In addition, ultrasonic cleaning preceding the transdermal administration of ascorbic acid by iontophoresis causes synergetic effects for skin beauty.

**WHAT IS CLAIMED IS:**

1. An ascorbic acid composition for inotophoresis comprising:

(a) 1 to 10wt% of a mixture comprising:

(i) 1 to 80wt% of additives comprising α -G-rutin, trehalose, aloe vera gel and alantoin in a weight ratio of 1-25 : 1-50 : 1-50 : 1-50; and

(ii) 20 to 99wt% of a metal phosphate salt of ascorbic acid; and

(b) 90 to 99wt% of water.

2. The ascorbic acid composition for inotophoresis according to claim 1, wherein the metal phosphate salt of ascorbic acid is selected from a group consisting of sodium ascorbyl phosphate, magnesium ascorbyl phosphate, calcium ascorbyl phosphate and potassium ascorbyl phosphate.

3. The ascorbic acid composition for inotophoresis according to claim 1, wherein the metal phosphate salt of ascorbic acid is magnesium ascorbyl phosphate.

4. A method for transdermal administration of ascorbic acid, characterized in that a metal phosphate salt of ascorbic acid is penetrated into skin by inotophoresis.

5. The method for transdermal administration of ascorbic acid according to claim 4, wherein the inotophoresis is conducted by placing one electrode on skin that is coated with an aqueous solution composition comprising a metal phosphate salt of ascorbic acid and constituting a circuit with the skin, thereby penetrating a metal phosphate salt of ascorbic acid into the skin.

6. The method for transdermal administration of ascorbic acid according to claim 4, wherein the inotophoresis is conducted by periodically generating a positive voltage of 3 to 20v at a pulse of 10-100Hz and a negative voltage of 3 to 20v at a pulse of 60-1000Hz, and applying them to skin at current of 0.01 to 1.0 mA, while applying ultrasonic vibrations of 23-40kHz to skin at a cycle of 1-100Hz.

7. The method for transdermal administration of ascorbic acid according to claim 5, wherein the aqueous solution composition comprises:

(a) 1 to 10wt% of a mixture of

(i) 20 to 99wt% of a metal phosphate salt of ascorbic acid; and

(ii) 1 to 80wt% of additives; and

(b) 90 to 99wt% of water.

8. The method for transdermal administration of ascorbic acid according to claim 7, wherein the additives comprise α -G-rutin, trehalose, aloe vera gel and alantoin in a weight ratio of 1-25 : 1-50 : 1-50 : 1-50.

9. The method for transdermal administration of ascorbic acid according to claim 4, wherein the metal phosphate salt of ascorbic acid is selected from a group consisting of sodium ascorbyl phosphate, magnesium ascorbyl phosphate, calcium ascorbyl phosphate, and potassium ascorbyl phosphate.

10. The method for transdermal administration of ascorbic acid according to claim 4, further comprising the step of ultrasonic cleansing of the skin before conducting the iontophoresis.

11. The method for transdermal administration of ascorbic acid according

to claim 10, wherein ultrasonic vibrations are generated through the following steps:

a skin-cleansing step in which ultrasonic vibrations of 20 to 40 kHz with a weak amplitude are generated;

a skin-scaling step in which ultrasonic vibrations of 20 to 40 kHz with a strong amplitude are generated; and

a lifting step in which ultrasonic vibrations of 20 to 40 kHz with a cycle of 1-100Hz and a pulse current of 0.01-0.1mA are generated.

12. The method for transdermal administration of ascorbic acid according to claim 4, further comprising a ultrasonic cleansing step before conducting the iontophoresis and a lifting step after the iontophoresis.

13. The method for transdermal administration of ascorbic acid according to claim 12, wherein the ultrasonic vibrations are generated through the following steps:

a skin-cleansing step in which ultrasonic vibrations of 20 to 40 kHz with a weak amplitude are generated; and

a skin-scaling step in which ultrasonic vibrations of 20 to 40 kHz with a strong amplitude are generated.

14. A skin-care apparatus comprising:

an electric source part to which an alternating current (AC) electric source is input;

a processor part that is operated by direct current (DC) supplied from the electric source part, and that controls the amplitude of vibrations,

operation time and an amount of iontophoresis current;

a resonance part that is connected to the electric source part by alternating current (AC) and causes pulses to resonate to ultrasonic waves;

an amplification part where the resonated pulses are amplified; and

an iontophoresis-vibration part that is connected to the amplification part, and that enables the iontophoresis and ultrasonic cleansing to be conducted by way of a contact plate that is in contact with skin, whereby vibrations are generated by piezoelectric elements attached to its surface.

15. The skin-care apparatus according to claim 14, further comprising a ground part that is connected to the contact plate.

16. The skin-care apparatus according to claim 14, further comprising a sponge cover that is inserted into an end of the contact plate, when transdermally administrated agents are penetrated into skin by iontophoresis.

17. The skin-care apparatus according to claim 16, wherein an insert groove is formed on both sides of the contact plate.

18. The skin-care apparatus according to claim 14, wherein a coating film made of titanium nitride or zirconium nitride is formed on a front end of the contact plate that is in contact with skin.

FIG. 1

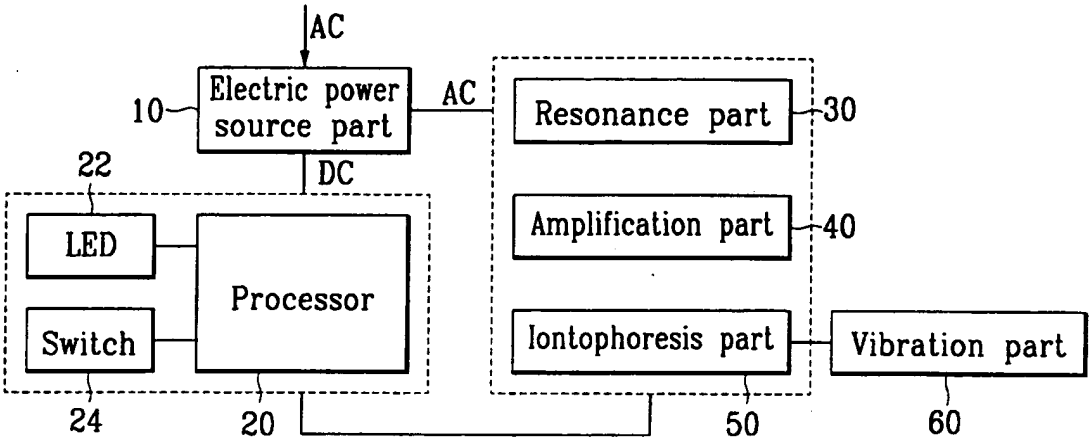



FIG. 2

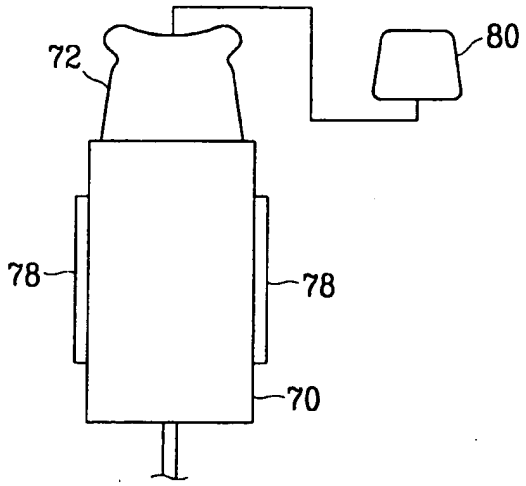



FIG. 3

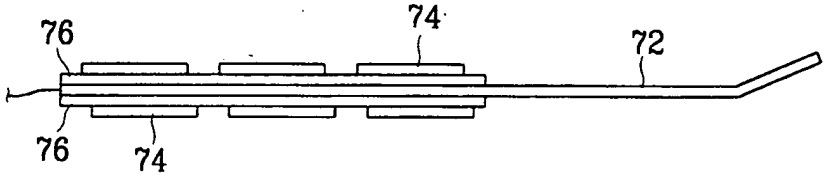
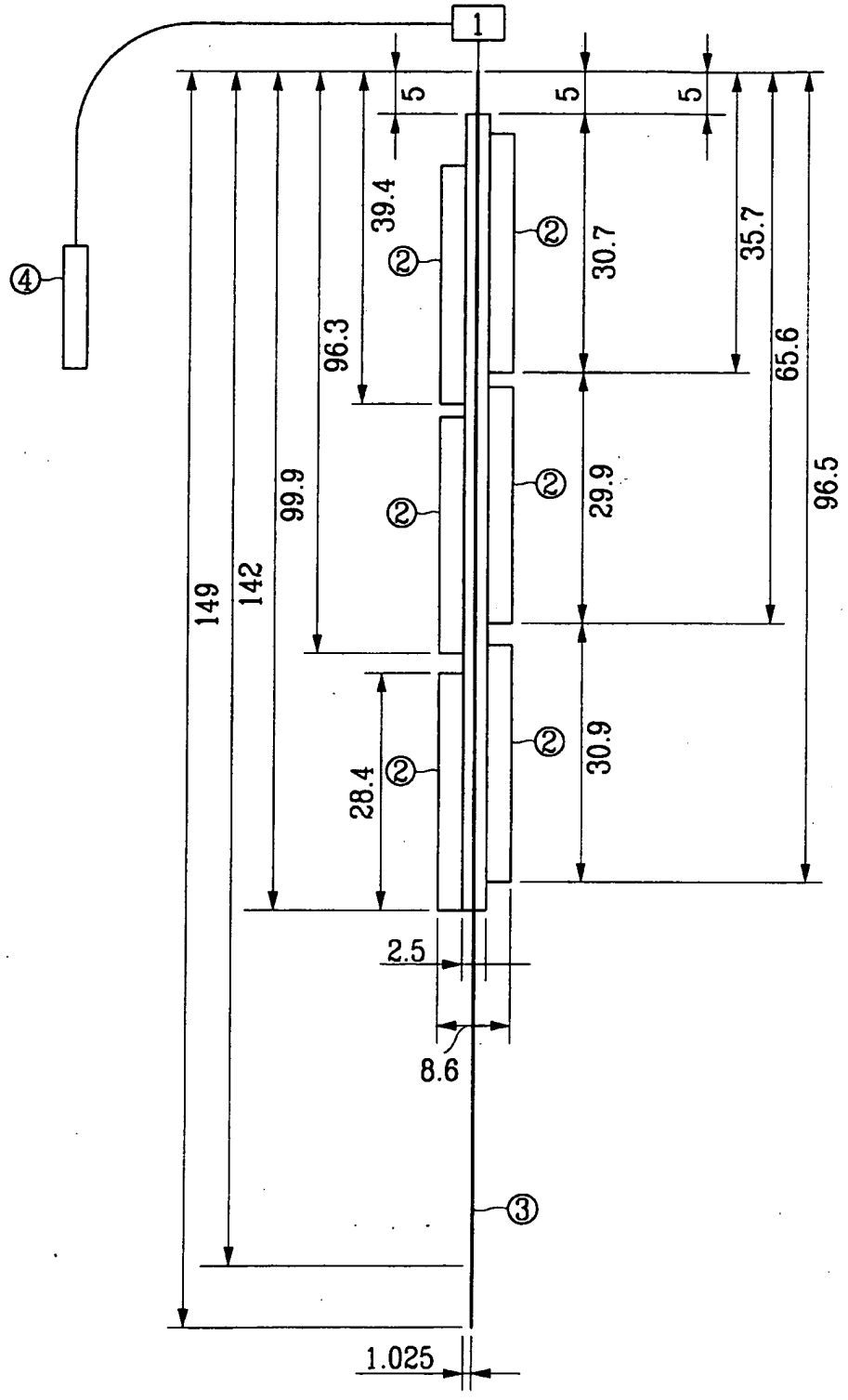


FIG. 4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30.7
35.7
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96.5
99.9
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30.9
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2.5
8.6
1.025
②
③
④

FIG.5

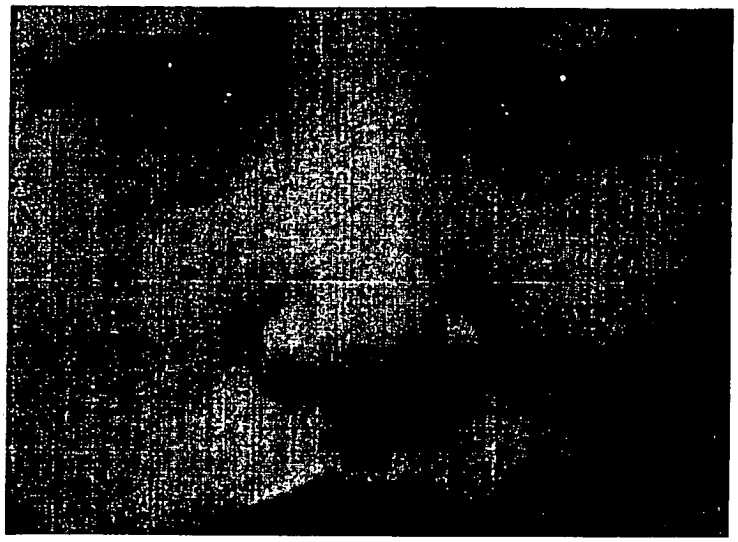


FIG.6

*FIG.7*

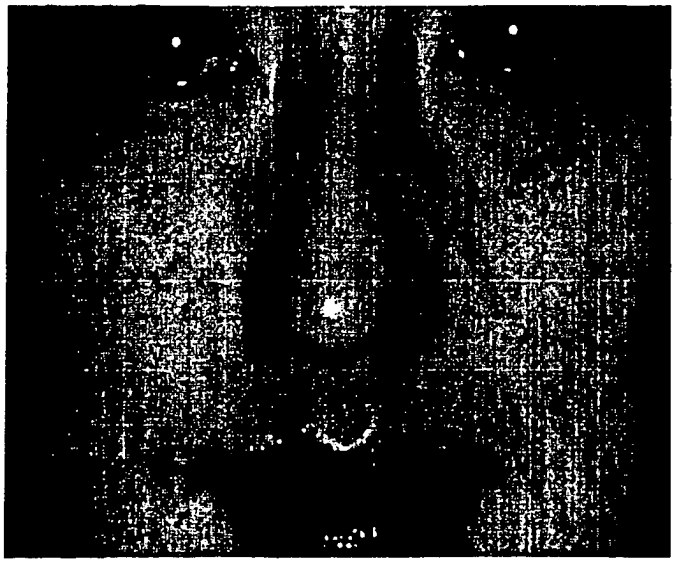


*FIG.8*

FIG.9

FIG.10

FIG.11

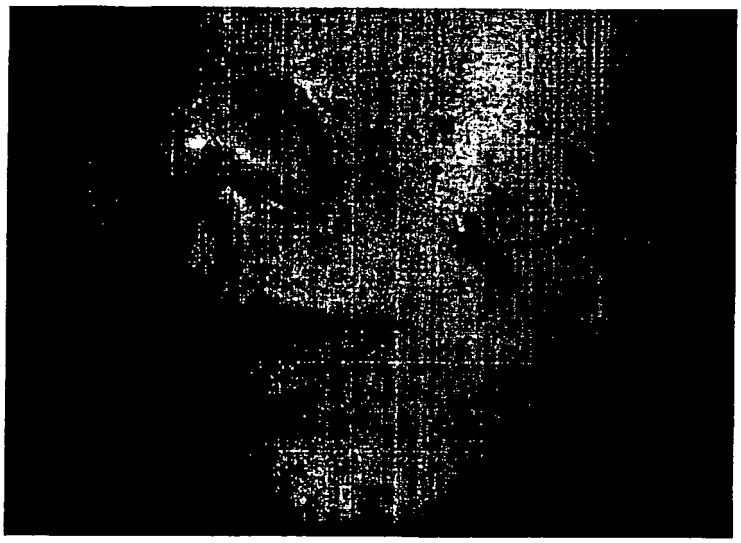
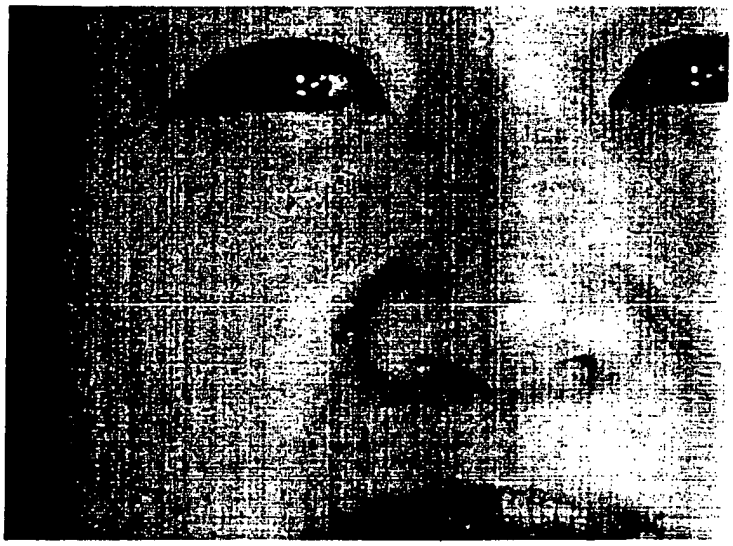


FIG.12

FIG.13

FIG.14



# INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR 01/00648

CLASSIFICATION OF SUBJECT MATTER

IPC[7]: A61N 1/30, A61K 31/375, 31/7016, 35/78, 31/7048,

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC[7]: A61N, A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC, PAJ, CAS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | US 6030374 A (Mc DANIEL) 29 February 2000 (29.02.00) *abstract; column 8, lines 54-62.* | 1-13 |
| A | WO 99/49878 A1 (MARY KAY INC.) 7 October 1999 (07.10.99) *page 10, line 20; page 11, lines 1,4,13,14; claims 1,2.* | 1-13 |

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☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
„A" document defining the general state of the art which is not considered to be of particular relevance
„E" earlier application or patent but published on or after the international filing date
„L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
„O" document referring to an oral disclosure, use, exhibition or other means
„P" document published prior to the international filing date but later than the priority date claimed
„T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
„X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
„Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
„&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 20 June 2001 (20.06.2001) | 3 July 2001 (03.07.2001) |
| Name and mailing adress of the ISA/AT<br>Austrian Patent Office<br>Kohlmarkt 8-10; A-1014 Vienna<br>Facsimile No. 1/53424/535 | Authorized officer<br>KRENN<br>Telephone No. 1/53424/435 |

Form PCT/ISA/210 (second sheet) (July 1998)

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR 01/00648

**Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 4-13 (please see remark)
because they relate to subject matter not required to be searched by this Authority, namely:

Remark:
Although claims 4-13 are directed to a therapeutic method of treatment of the human/animal body, the search has been carried out and based on the alleged effects of the composition (see PCT-Article 17, rule 39.1.iv).

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

1., A pharmaceutical composition comprising (i) a metal phosphate of ascorbic acid, (ii) alpha-G-rutin, (iii) trehalose, (iv) aloe vera gel and (v) alantoin resp. a method for transdermal administration of the same (claims 1-13).

2., A skin-care apparatus (claims 14-18)

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-13

**Remark on Protest**
☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR 01/00648

| Patent document cited in search report | | | Publication date | Patent family member(s) | | | Publication date |
|---|---|---|---|---|---|---|---|
| US | A | 6030374 | 29-02-2000 | AU | A1 | 32084/99 | 25-10-1999 |
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| | | | | SK | A3 | 2432000 | 12-09-2000 |
| | | | | US | A | 5920995 | 13-07-1999 |
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| | | | | WO | B1 | 9930101 | 15-07-1999 |
| WO | A1 | 9949878 | 07-10-1999 | AU | A1 | 33689/99 | 18-10-1999 |